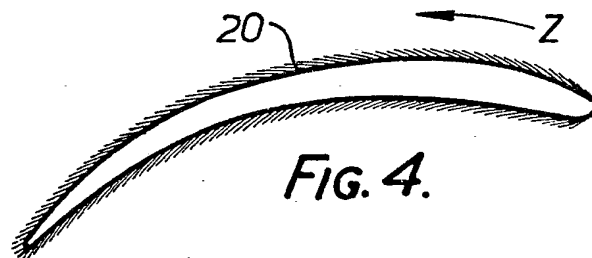
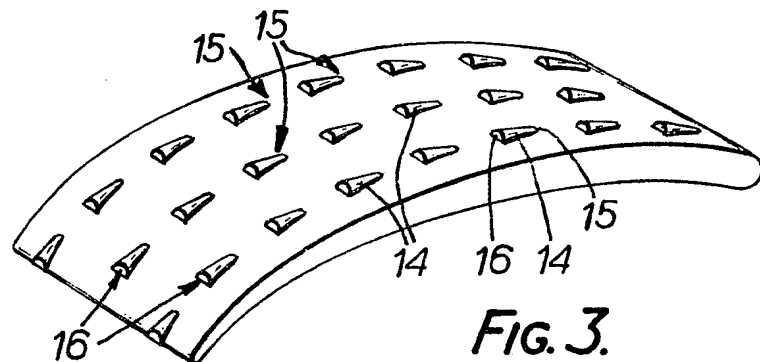


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(54) **Fan pump and turbine blades**

(57) A blade or vane for a fluid machine or duct, such as a fan, pump, or turbine, provided with large numbers of small uni-directional projections on its external surfaces. The projections may be rigid or flexible, but essentially they are

directed downstream in relation to the direction of flow. In one form, Fig. 3, the projections 14 are displaced from the general plane of the surface with smooth sloping upstream areas 15 and abrupt transverse downstream surfaces 16. In another form, Fig. 4, the projections 20 are in the form of small flexible fibres.



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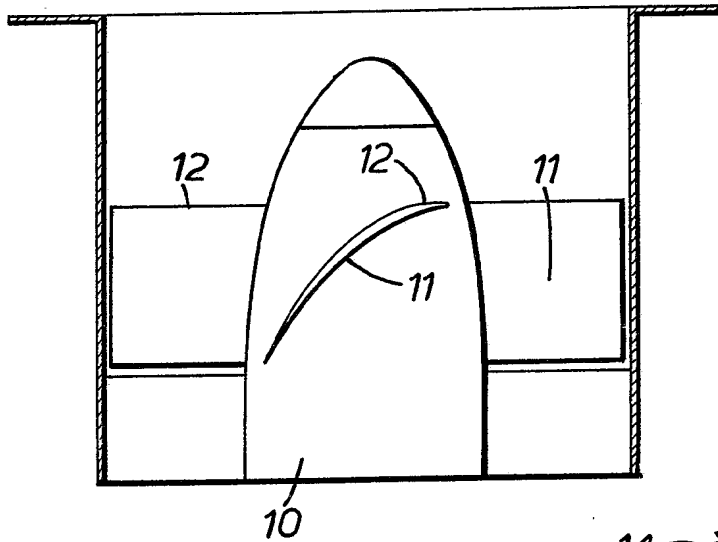


FIG. 1.

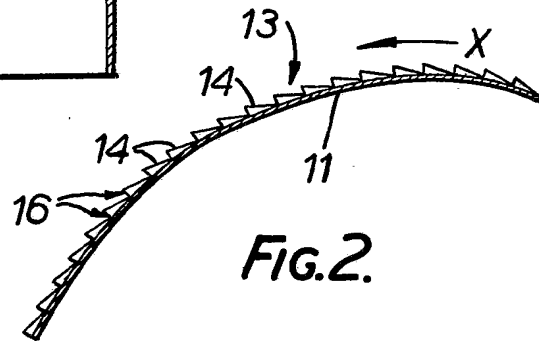


FIG. 2.

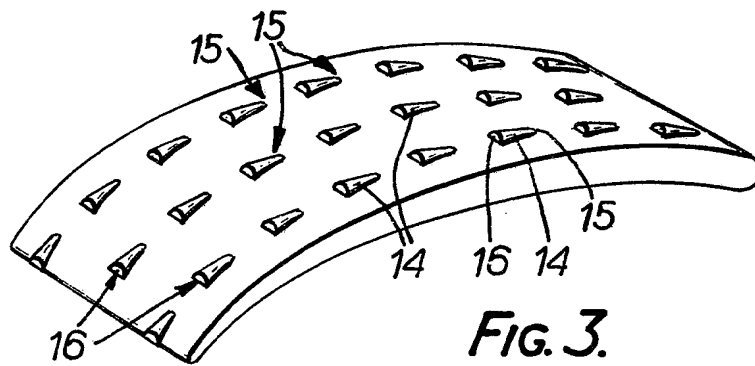


FIG. 3.

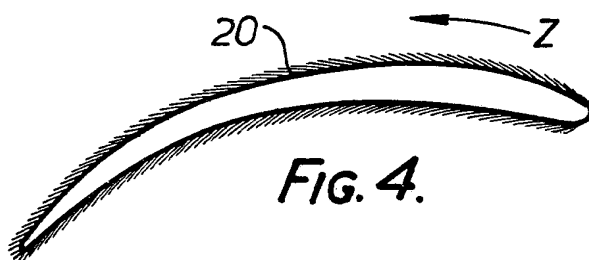


FIG. 4.



FIG. 5.

SPECIFICATION

Fan pump and turbine blades

This invention relates to so-called "fluid flow elements" such as fan pump and turbine blades.

- 5 The invention is, however, applicable to any element whether moving or fixed, which in use is in contact with a relatively moving fluid stream. The stream may be a liquid or a gas and the element may be a blade as mentioned, or it may be some other moving part such as the hub of a fan or pump. The element may also be the wall of a pipe or any other body over which fluid flows.

It is an object of the invention to improve the fluid flow characteristics of such an element.

- 15 Preferred forms of the invention may reduce the frictional drag between the element and the fluid stream, improve the aero-dynamic streamline properties, and consequently increase the efficiency of the fluid flow.

- 20 Broadly stated the invention consists in a fluid flow element having a surface formed or provided with projections and/or indentations having a unidirectional characteristic. In one form of the invention the projections are rigid and have inclined, smooth, or aerofoil profiles at their leading ends and relatively blunt, sharp or barbed surfaces at their trailing ends. Alternatively the projections may be flexible or movable and they may, for example, consist of short fibres or bristles of any suitable material.

In some forms of the invention the surface is a rigid metallic structure. The surface may be separately formed and made attachable to the basic element.

- 35 The invention also consists in a blade for a fan pump impeller or turbine having a fluid flow element as defined above.

The invention may be performed in various ways and one specific embodiment with some possible modifications will now be described by way of example with reference to the accompanying drawings, in which:—

Figure 1 is a diagrammatic side view of the hub of an air fan,

- 45 Figure 2 is a diagrammatic sectional view through a blade of the fan,

Figure 3 is a perspective view on a further enlarged scale illustrating some of the rigid projections formed on the blade surface,

- 50 Figure 4 is a similar sectional view illustrating another embodiment, including short splines or bristles, and

- Figure 5 is a cross-section through an aircraft wing incorporating a surface according to the invention.

- 60 The fan hub illustrated in Figure 1 is of the usual rounded or pointed shape 10 and has a number of fan blades 11, which are in this case formed of thin sheet material curved to provide a shallow entry angle at the leading edge 12. On one or both surfaces of each blade there are

formed a number of small "uni-directional" projections 13. Each of these has a smooth

- 65 inclined flank 14 running up to the leading edge 15 of the projection and the trailing edge 16 is a blunt transverse shoulder. Large numbers of these projections are provided over the surface of the blade and the effect is to encourage movement of the air in the direction of the arrow X and to cause resistance to flow in the opposite direction. It is believed that this improves the efficiency of the interaction between the air and the blade by improving the streamline flow in the direction of the arrow X and reducing the tendency for turbulence.

As a result it may be possible to increase the pitch of portions of the blade, so as to improve the impeller effect of the fan, without causing turbulence.

- 80 The projections may be formed by punching out lugs from the sheet metal blade, or the projections may be formed separately and attached to the blade itself.

- In the second example illustrated in Figure 4 the blade is provided with large numbers of short splines or bristles 20 distributed over its surface, and particularly the cambered convex surface. These "bristles" may be rigid such as short metal wires or fibres, or they may be relatively flexible or movable, for example short plastics fibres. In the latter case the whole surface may be provided by a piece of fabric material having an appropriate nap in the direction of the arrow Z. Other possible uses and applications of the invention are to ships propellers or boat hulls, helicopter blades, external aircraft surfaces, windmills, centrifugal pump impellers and casings, rocket components, jet nozzles, stator and rotar turbine and compressor blades.

100 CLAIMS

1. A fluid flow element having a surface formed or provided with projections and/or indentations having a uni-directional characteristic.

- 105 2. An element according to Claim 1, in which the projections are rigid and have inclined, smooth, or aerofoil profiles at their leading ends and relatively blunt, sharp or barbed surfaces at their trailing ends.

- 110 3. An element according to Claim 1, in which the projections are flexible or movable.

4. An element according to any of the preceding claims, in which the surface is a rigid metallic structure.

- 115 5. An element according to any of the preceding claims, in which the surface is separately formed and is attachable to the basic element.

- 120 6. A blade or vane for a fluid fan, pump, impeller, motor or turbine, having a fluid flow element as defined in any of the preceding claims.

7. A fluid flow element, or a fluid fan, pump,

impeller, motor or turbine, including such an
element, substantially in any of the forms

described herein with reference to the
accompanying drawings.

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